

Pressure, force and area are related by a formula. The formula can be written in different ways, depending on which quantity you need to calculate. Choose the formula that has the quantity you want to calculate on the left-hand side of the equals sign.

pressure = force ÷ area
 force = pressure × area
 area = force ÷ pressure
 1 Pa = 1 N/m²
 1 m² = 10 000 cm²

The weight of a bicycle is supported by the pressure of the air inside the tyres. If the tyres are pumped up hard there is a small area of the tyre in contact with the ground. If the air in the tyres is at a low pressure the tyres are easy to squash and the area of the tyre in contact with the ground gets bigger. The total area of the tyres in contact with the ground can be calculated from the pressure of the air in the tyres and the total weight of the bike and its rider.

Sam has three different bicycles. Sam's weight is 700 N.

Road bike

weight: 90 N
 tyre pressure: 760 kPa



Mountain bike

weight: 130 N
 tyre pressure: 170 kPa



Touring bike:

weight (loaded): ?
 tyre pressure: 550 kPa



- 1 Calculate the total tyre area in contact with the ground for:
 - a Sam on his road bike.
 - b Sam on his mountain bike.
- 2 Explain why the road bike and mountain bike have very different tyre pressures.
- 3 When Sam is on his touring bike the tyre area in contact with the ground is 0.0015 m². Calculate the total weight of Sam and his bike.

This is a quad bike. Farmers often use them to help them to carry animals or travel across muddy fields. Its weight (including farmer and dog!) is 4000 N and the total area of tyres in contact with the ground is 0.083 m².

An off-road vehicle has a weight of 26 000 N (including the driver) and the total area of tyres in contact with the ground is 0.113 m².

- 4 Which vehicle will sink deepest into mud? Explain your answer (you will need to carry out some calculations to help you to explain).



I can...

- explain applications of pressure in different situations
- use the formula relating force, pressure and area.